CLAIMS

1. A decision directed phase locked loop circuit, comprising:

a phase detector which receives a sequence of baseband complex samples and current phase estimates and generates phase differences between said baseband complex samples and current phase estimates;

a block decoder which decodes said baseband complex samples to generate partial decoder values and decoded data;

a phase error generation circuit which receives said baseband complex samples and said partial decoder values from said block decoder and which generates feedback phase error terms based on said baseband complex samples and said partial decoder values;

a loop filter which filters said phase error terms; and

a phase accumulator that updates the current phase estimate on each iteration of the phase locked loop.

2. A decision directed phase locked loop as claimed in claim 1, wherein the baseband complex samples are demodulated from an input modulated signal corresponding to one of a binary phase shift keying (BPSK) modulated signal and a quaternary phase shift keying (QPSK) modulated signal and encoded by a sequence of codewords.

3. A decision directed phase locked loop as claimed in claim 2, wherein said codewords correspond to biorthogonal binary codes.

4. A decision directed phase locked loop as claimed in claim 3, wherein each of said codewords contains four data symbols, and the decode rate for decoding a set of vector pairs of phase stabilized observables corresponds to one quarter of a symbol rate.

5. A decision directed phase locked loop as claimed in claim 4, wherein said block decoder comprises a Reed-Muller block decoder.

6. A decision directed phase locked loop as claimed in claim 5, wherein said phase error generation circuit generates said feedback phase error terms based on the composite decoded codeword phase error relative to reference.

7. A decision directed phase locked loop as claimed in claim 6, wherein said current phase estimate is updated at one quarter the symbol rate.

8. A decision directed phase locked loop as claimed in claim 6, wherein said current phase estimate is updated every codeword of four data symbols.

9. A decision directed phase locked loop as claimed in claim 1, wherein said phase detector includes a subtractor for subtracting the incoming phase of said baseband complex samples from the current phase estimate to generate said phase differences.

10. A communication receiver using a demodulator for receiving an input modulated signal from a transmission channel which is encoded by a sequence of codewords, comprising:

a down converter which generates a succession of baseband signal samples of said input modulated signal including an in-phase component and a quadrature-phase component;

a first converter which converts said succession of baseband signal samples of said input modulated signal from a rectangular form into a pair of polar coordinates having an incoming phase; and

a phase locked loop which estimates the phase of said input modulated signal, said phase locked loop comprising:

a comparator which generates a phase difference of said incoming phase of said input modulated signal and an estimated phase;

a second converter which converts said polar coordinates having said phase difference into a set of vector pairs of phase stabilized observables in said rectangular form;

a block decoder which decodes said set of vector pairs of phase stabilized

observables in said rectangular form at a decode rate to generate decoded data and a phase error estimate; and

a loop filter which filters said phase error estimate from said block decoder to yield an update of said estimated phase at each codeword.

11. A communication receiver as claimed in claim 10, wherein said input modulated signal corresponds to one of a binary phase shift keying modulated signal and a quaternary phase shift keying modulated signal.

12. A communication receiver as claimed in claim 10, wherein said codewords correspond to biorthogonal binary codes.

13. A communication receiver as claimed in claim 11, wherein each of said codewords contains four data symbols, and said decode rate for decoding said phase stabilized observables corresponds to one quarter of a symbol rate.

14. A communication receiver as claimed in claim 11, wherein said block decoder comprises a Reed-Muller block decoder.

15. A communication receiver as claimed in claim 14, wherein said Reed-Muller block decoder determines the phase error estimate based on the composite decoded codeword phase error relative to reference.

16. A communication receiver as claimed in claim 15, wherein said estimated phase is updated at one quarter the symbol rate.

17. A communication receiver as claimed in claim 15, wherein said estimated phase is updated every codeword of four data symbols.

18. A communication receiver as claimed in claim 10, wherein said comparator includes a subtractor for subtracting said incoming phase of said input modulated signal from said estimated phase to generate said phase difference.

19. A communication receiver as claimed in claim 10, wherein said down converter down converts said input modulated signal into an intermediate frequency signal, and wherein said communication receiver further comprises:

a synchronous demodulator which demodulates said intermediate frequency signal from a baseband quadrature pair into a sequence of complex sample pairs; and

a matched filter and sampler which passes said sequence of complex sample pairs and samples at a symbol rate to produce said succession of baseband signal samples.

20. A communication receiver for receiving an input modulated signal encoded by a sequence of codewords, comprising:

a converter which converts the input modulated signal encoded by said sequence of codewords into a series of phase stabilized observables in rectangular form for each codeword; and

a phase locked loop comprising a block decoder which decodes said phase stabilized observables at a decode rate to generate decoded data and an estimate of a phase error of the input modulated signal by derotation of the series of phase stabilized observables based on said decoded data and updates said phase error at each codeword.

21. A communication receiver as claimed in claim 20, wherein said input modulated signal corresponds to one of a binary phase shift keying modulated signal and a quaternary phase shift keying modulated signal, wherein said codewords correspond to biorthogonal binary block codes, and wherein each of said codewords contains at least four data symbols, and said decode rate for decoding said phase stabilized observables corresponds to one quarter of a symbol rate.